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Analysis of Risk Factors and Blood Group Related to Primary Angle-Closure Glaucoma

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Abstract

Objective: To investigate the risk factors and blood type analysis of primary acute angle-closure glaucoma. **Methods:** A retrospective analysis of 615 patients with primary angle-closure glaucoma admitted to the Affiliated Hospital of Youjiang Medical College for Nationalities from January 2015 to December 2024, and 2696 patients diagnosed with age-related cataract in the same period were used as the control group. The age, gender, family history of glaucoma and blood type distribution characteristics of the two groups were observed. **Results:** There were 143 male patients in the PACG group, accounting for 23.25% of the total number, and 472 female patients, accounting for 76.75% of the total number, with a male to female ratio of 0.30:1. There were 1204 male patients in the control group, accounting for 44.66% of the total number, and 1492 female patients, accounting for 55.34% of the total number, with a male to female ratio of 0.81:1. The difference between the two groups was statistically significant ($P < 0.05$). The mean age of PACG group was 64.04 ± 10.19. Patients in the 60 - 69 age group were the most, accounting for 37.72% of the total number; followed by 70 - 79 years old and 50 - 59 years old, accounting for 26.34% and 22.44% of the total number, respectively. In the control group, the mean age was 70.44 ± 8.67. The patients in the 70 - 79 age group were the most, accounting for 42.88% of the total number, followed by the 60 - 69 age group, accounting for 31.42% of the total number. The difference between the two groups was statistically significant ($P < 0.05$). There were 86 cases with family history of glaucoma in the PACG group, and no family history of glaucoma in the control group. The difference between the two groups was statistically significant ($P < 0.05$). The distribution of ABO blood group in PACG group: O type (n = 296, 48.13%) > B type (n = 173, 28.13%) > A type (n = 122, 19.84%) > AB type (n = 24, 3.90%). The distribution of ABO blood group in the control group: O type (n = 1320, 48.96%) > B type (n = 708,

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26.26%) > A type (n = 533, 19.77%) > AB type (n = 135, 5.01%). The results of single factor analysis showed that there was no significant difference (P > 0.05). **Conclusion:** Middle-aged and elderly women with a family history of glaucoma are high-risk factors for PACG. Whether blood type is related to the pathogenesis of glaucoma still needs further discussion. We should focus on people with high-risk factors for PACG, and try to achieve early prevention, early detection and early treatment.

Keywords

Primary Angle-Closure Glaucoma, Risk Factors, Blood Type

1. Introduction

Glaucoma is a group of diseases characterized by characteristic optic nerve damage and visual field defect. Glaucoma is the first irreversible blinding eye disease in the world. According to the epidemiological survey of Tham *et al*. [1], at least 80 million people around the world are suffering from glaucoma. It is expected that the number of global glaucoma patients will exceed 110 million by 2040. China's glaucoma survey report shows that as of 2020, the number of glaucoma patients in China has reached 21 million, ranking first in the world [2]. China Glaucoma Guide (2020) points out that with the aging of the population, the prevalence of glaucoma in China is increasing year by year. At present, China is the country with the most serious glaucoma-related visual impairment in the world [3].

Glaucoma can be divided into three types, including primary, secondary and congenital. Primary glaucoma is the main type of glaucoma. According to the anatomical structure, it is divided into primary open-angle glaucoma (POAG) and primary angle-closure glaucoma (PACG). The prevalence of different types of glaucoma varies significantly by country, region and race. Primary open-angle glaucoma (POAG) is the most common type of primary glaucoma in European and African populations, while primary angle-closure glaucoma (PACG) is more common in Asia, especially in East Asia and China, while the prevalence of PACG in Europe is significantly lower [4]. Glaucoma causes irreversible damage to the optic nerve, resulting in a gradual loss of visual function, causing great harm to society, families and individuals. At present, there are four problems in glaucoma research: early diagnosis of glaucoma, pathogenesis of glaucoma, glaucoma optic nerve damage and protection, and maintenance of functional filtering blebs after glaucoma surgery. Therefore, it is still a great challenge for ophthalmologists to understand the pathogenesis and risk factors of glaucoma, to further understand the occurrence and development of glaucoma, to diagnose glaucoma early, and to take effective prevention and treatment measures as soon as possible.

For PACG, its pathogenesis is not yet clear. Researchers believe that PACG patients have abnormal anatomical features such as short axial length, shallow ante-

rior chamber, narrow anterior chamber angle, thicker lens and anterior lens position [5]. With the change of medical model and the deepening of research, the pathogenesis of PACG is not only related to the abnormal anatomical structure of the eye, but also closely related to heredity, personality, stress response and psychological factors [6]. Through retrospective study, this study analyzed the clinical characteristics of primary acute angle-closure glaucoma from gender, age, family history of glaucoma, blood type and other factors, in order to provide guidance for clinical work and theoretical support for early diagnosis and prevention of glaucoma.

2. Research Data and Methods

2.1. Research Object

The inpatients diagnosed as PACG in the Affiliated Hospital of Youjiang Medical College for Nationalities from January 2015 to December 2024 were collected as the case group, and the inpatients diagnosed as age-related cataract in the same period were collected as the control group for retrospective analysis. The study met the requirements of ethics and was ethically reviewed. All patient data included in this study were kept confidential.

2.2. Collection of Case Data

2.2.1. Collection Methods

Through the electronic medical record home page system of our hospital, the admission time was derived from January 2015 to December 2024, including PACG (disease diagnosis code: H40.202) inpatients and senile cataract (disease diagnosis code: H25.900) patients, and their basic information (including hospitalization medical record number, name, gender, age, family history of glaucoma, blood type) was collected. A total of 3311 cases were derived, including 615 PACG patients as the case group and 2696 senile cataract patients as the control group.

2.2.2. Inclusion Criteria of Cases

1) Patients diagnosed as PACG and senile cataract by our department.

2) Complete medical records.

2.2.3. Exclusion Criteria of Cases

1) Patients who were not classified or classified as other types of glaucoma and cataract were excluded.

2) Patients with incomplete clinical data.

3) Patients with incomplete examinations, such as blood type identification, were not included.

2.3. Observation Indicators

The gender, age, family history of glaucoma, and blood type of the two groups were observed.

2.4. Statistical Methods

Collect relevant case data, use EXCEL to screen and sort out the data, and then use SPSS 27.0 statistical software to analyze and process the data. The count data will be expressed by frequency and percentage (%), and the chi-square test is used for comparison between groups. The measurement data with normal distribution were expressed as mean ± standard deviation ($\overline{x} \pm s$). Two independent sample t-tests were used for comparison between groups with normal distribution and homogeneity of variance. For the measurement data that do not conform to the normal distribution or the variance is not neat, the median [M (P25, P75)] is used. The non-parametric rank sum test is used to compare whether there is statistical significance between the case group and the control group. The detection level was $\alpha = 0.05$, and $P < 0.05$ indicated that the difference was statistically significant.

3. Results

3.1. Gender

In this study, there were 615 PACG patients who met the inclusion criteria, including 143 male patients, accounting for 23.25% of the total number, 472 female patients, accounting for 76.75% of the total number, and the ratio of male to female was 0.30:1. There were 2696 cases in the control group, including 1204 male patients, accounting for 44.66% of the total number, 1492 female patients, accounting for 55.34% of the total number, and the ratio of male to female was 0.81:1. Univariate analysis showed that the difference between the two groups was statistically significant ($P < 0.05$) (Table 1).

Table 1. Gender comparison between case group and control group.

Gender	case group (n = 615)	control group (n = 2696)	χ^2	P
Male	143 (23.25%)	1204 (44.66%)	95.092	<0.01
Females	472 (76.75%)	1492 (55.34%)		

3.2. Age

Among the PACG patients who met the inclusion criteria, the youngest was 13 years old, the oldest was 90 years old, and the mean age was 64.04 ± 10.19. Patients in the 60 - 69 age group were the most, accounting for 37.72% of the total number; followed by 70 - 79 years old and 50 - 59 years old, accounting for 26.34% and 22.44% of the total number, respectively. There were fewer patients under 40 years old and over 80 years old. In the control group, the youngest was 40 years old, the oldest was 95 years old, and the mean age was 70.44 ± 8.67. The patients in the 70 - 79 age group were the most, accounting for 42.88% of the total, followed by the 60-69 age group, accounting for 31.42% of the total. Univariate analysis showed that the difference between the two groups was statistically significant ($P < 0.05$) (Table 2).

Table 2. Comparison of age between case group and control group.

Age	case group (n = 615)	control group (n = 2696)	χ^2	P
($\bar{x} \pm s$)	64.04 ± 10.19	70.44 ± 8.67		
≤20 y	2 (0.33%)	0	241.081	<0.001
20 - 29 y	0	0		
30 - 39 y	6 (0.98%)	0		
40 - 49 y	43 (6.99%)	32 (1.19%)		
50 - 59 y	138 (22.44%)	278 (10.31%)		
60 - 69 y	232 (37.72%)	847 (31.42%)		
70 - 79 y	162 (26.34%)	1156 (42.88%)		
≥80 y	32 (5.20%)	383 (14.20%)		

3.3. Family History of Glaucoma

There were 86 cases of family history of glaucoma in the PACG group and no family history of glaucoma in the control group. The difference between the two groups was statistically significant (P < 0.05) (Table 3).

Table 3. Comparison of family history between case group and control group.

Family history of glaucoma	case group (n = 615)	control group (n = 2696)	χ^2	P
Yes	86 (13.98%)	0 (0%)	387.005	<0.001
No	529 (86.024%)	2696 (100.0%)		

3.4. Blood Group

The ABO blood group of the PACG group and the control group was screened by EXCEL table. The ABO blood group distribution of the case group was: O type (n = 296, 48.13%) > B type (n = 173, 28.13%) > A type (n = 122, 19.84%) > AB type (n = 24, 3.90%). The distribution of ABO blood group in the control group: O type (n = 1320, 48.96%) > B type (n = 708, 26.26%) > A type (n = 533, 19.77%) > AB type (n = 135, 5.01%). The results of single factor analysis showed that there was no significant difference (P > 0.05) (Table 4).

Table 4. Comparison of blood group between case group and control group.

blood group	case group (n = 615)	control group (n = 2696)	χ^2	P
A	122 (19.84%)	533 (19.77%)	2.003	0.572
B	173 (28.13%)	708 (26.26%)		
AB	24 (3.90%)	135 (5.01%)		
O	296 (48.13%)	1320 (48.96%)		

4. Discussion

The pathogenesis of primary angle-closure glaucoma is complex and diverse. This study found that the 50 - 79 years old is the most common age group of PACG, accounting for 86.4%. Female and family history of PACG are high risk factors for PACG, which is consistent with previous research results [7] [8].

The exact reason for the gender difference in the prevalence of PACG is unclear. It is speculated that the difference in anatomical structure and endocrine function between men and women may lead to greater susceptibility to angle closure in women than in men. Compared with men, women have shorter axial length, shallower anterior chamber, and a more anterior lens position. Under the action of these factors, the ciliary lens is more prone to block [9].

Previous studies have shown that advanced age is an important risk factor for PACG. The prevalence of PACG increases with age. The prevalence of PACG in people over 50 years old is 3 - 30 times higher than that in people under 50 years old [10]. This study also confirmed that the prevalence of PACG in the study population was related to age. Studies have shown that the increase of age is related to the shallowing of the anterior chamber, and with the increase of age, due to the accumulation of extracellular matrix in trabecular meshwork and ciliary muscle and the decrease of trabecular meshwork cells, the aqueous outflow capacity will decrease and the intraocular pressure will increase, which will eventually lead to the characteristic progressive lesions of angle closure and optic nerve [11].

With the deepening of research, it has been found that glaucoma is a psychosomatic disease with a certain genetic tendency, but its genetic nature and genetic law are not clear. Clinical observation and epidemiological studies have found that many patients with primary angle-closure glaucoma or acute angle-closure glaucoma do have certain common personality traits, such as high mood swings, easy to be nervous and anxious, being competitive, high work pressure, a lack of patience, and being irritable. It is a typical type A personality manifestation, also known as "glaucoma personality". Although not all glaucoma patients have this personality, statistically, these people have a higher risk of glaucoma [12]-[15]. In the study of patients with open-angle glaucoma abroad, 64% of the subjects showed type A behavior [16]. However, there are many differences in whether there is a link between blood type and personality. In Japan, South Korea, and other countries, the belief in blood type personality theory is strong, and it is believed that blood type is related to personality and behavior. However, Aithal's study found that blood type has no correlation with human motivation process, theory and behavior [17].

ABO blood group system is the earliest discovered blood group system, and it is also the most widely used and meaningful blood group system. It is hereditary. Studies have found that ABO blood group is closely related to the occurrence of coronary heart disease, hypertension, hematological diseases, malignant tumors and other diseases [18]-[21]. There are few reports on whether there is a correlation between glaucoma patients and blood group at home and abroad, and there

is no unified conclusion. This study found that type O was the most common blood type in PACG patients, followed by type B. However, statistical analysis showed that there was no significant difference between the two groups. In the past, Yu Luzhen [22] counted the blood types of 100 glaucoma patients and found that O type > A type > B type > AB type. The results of Jiang Delu [23] and other studies showed that the blood type distribution of PACG was type B > type O > type A > type AB. Zhang Xiuli [24] and other studies have found that type A blood is the most common in PACG patients, and that the incidence of glaucoma is related to blood type. Xie Xiuqiang *et al*. [25] studied the distribution of blood types in glaucoma patients as type O > type A > type B > type AB, but from statistical analysis, it is believed that ABO blood type is not exactly related to the incidence of glaucoma.

The author believes that there are obvious regional differences in the distribution of blood groups. The formation of personality is related to heredity, personal educational background, life experience, social environment, and so on. Blood group genetics is closely related to human health, but whether blood group is related to the incidence of glaucoma still needs further discussion. At present, with the aging of the social population and the increase of the incidence of glaucoma, we should pay attention to the popularization and education of glaucoma prevention and treatment knowledge for middle-aged and elderly women, especially for high-risk groups with a family history of glaucoma, and pay attention to the psychological state of the population. Try to achieve early prevention, early detection and early treatment.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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